

Self-regulation, Threat Perception, and Perceived Parental Support: an fMRI Investigation of Children with ADHD

A. Project Purpose

This thesis will examine whether perceived parental support mediates problems with executive control and cognition often seen in youth with ADHD, using a Go No-Go task during a functional MRI scan, neuropsychological assessments, and blood pressure monitoring.

B. Project Importance

It is estimated that between 5-10% of children and adolescents in the United States have been diagnosed with attention-deficit/hyperactivity disorder (ADHD) (Evans, Morrill, & Parente, 2010, p. 657). Pediatric populations typically experience attention and academic problems and diminished peer and family relationships. Parent-child relationships experience increased conflict and poorer parenting practices (Humphreys, Katz, Lee, & Hammen, 2013, p. 854-855). Interpersonal difficulties among both peers and family members put children with ADHD at risk for comorbid disorders, including depression, anxiety, and oppositional defiant disorder (ODD), and may lead to an increased risk for suicide, the 3rd leading cause of death among adolescents in the United States. Developmentally appropriate self-regulation allows for social flexibility and goal-oriented motivation, traits often diminished in children with ADHD (Berger, Kofman, Livneh, & Henik, 2007, p. 256). Interventions that target strengthening inhibitory control during adolescence may decrease the severity of negative behaviors related to inattention and impulsivity.

Previous studies have suggested that incidence rate of ADHD is significantly higher in single-parent families (Choi, Kwon, Lim, Lim, & Ha, 2016, p. 43), and that parents who show support for child autonomy can significantly decrease bullying behavior in children with ADHD

(Rajendran, Kruszewski, & Halperin, 2015, p. 190). However, very little research has been done on children's own perception of parental support or on the strength of parent's marital quality as mediating factors on the negative symptomology of ADHD. Additionally, prior research that has looked at social support in adolescent ADHD populations has mainly focused on self-report of academic and behavioral success (Mastoras, Saklofske, Schwean, & Climie, 2015) rather than on physiological correlates of executive control. This project will bridge this gap in the current literature.

C. Project Overview

Participants will be recruited from the Utah County community. After screening and scheduling, participants will first arrive at the BYU Health and Behavior Research Lab (1039 SWKT) where they will be given a paper copy of the consent form. Upon completion of informed consent, both parent and child will have three blood pressure measure taken, each one minute apart. After this, participants and their parents will then complete paper measures to examine demographic and health information. After this, they will be separated to complete paper measures on relationship quality and family functioning. For the parent, this will include assessments of the relationship quality with their spouse as well as their child. For the adolescent, this will include assessments of the relationship quality with each of their parents. While separated, the adolescents will also participate in a short (15-20 minute) qualitative interview assessing their thoughts and perceptions on self-control in school and home settings and their family relationships. The adolescent will also complete approximately 20 minutes of neuropsychological assessment to assess cognitive ability using the NIH Toolbox iPad application. The parent will wait outside of the lab during the duration of the interview and the iPad cognitive testing.

Upon completion of the paper measures, both the parent and child will move down to the BYU MRI Research Facility where the adolescent will be given a paper copy of the MRI safety screener to confirm the safety screening they completed prior to being scheduled. Adolescent participants will be scanned using a Siemens 3-Tesla scanner. Parents will wait in the lobby of the MRI Research Facility, where magazines are available as reading material, as well as a wireless Internet connection. First, high resolution structural magnetic resonance imaging (sMRI) will also be conducted for each participant to allow for spatial normalization and localization of functional neural activity. Each adolescent participant will then undergo functional scanning while performing a behavioral task meant to assess brain activation during executive control. They will complete a go/no-go task developed by Batterink and colleagues (2010) examining inhibitory control while viewing food images. Participants will be instructed to respond with a button press to all vegetables and to avoid pressing the button when viewing desserts. Participants will also be instructed to respond as quickly and accurately as possible. Reaction times will be measured using a fiber-optic response system. Participants will view the screen using a mirror attached to the head coil. This behavioral task has been used in prior studies examining adolescent populations. The neuroimaging portion of the study is expected to require 30 minutes per participant per measurement occasion.

Following the scan, the adolescent and the parent will be thanked for their participation and paid \$40 each. The adolescents will also receive a digital image of their brain approximately one week after their participation.

D. Thesis Committee

My faculty advisor will be Dr. Wendy Birmingham from the Psychology department. Dr. Birmingham is a social health psychologist and is qualified to study how social support may

mediate health problems in children with ADHD, a current gap in the research. She is also currently a co-investigator on another study looking at parent-child social support. I have worked with Dr. Birmingham for more than two years and have worked as her lab manager for a year. We have worked together previously on many studies that examine health and social support, including a previous fMRI study.

My faculty reader will be Dr. Brock Kirwan from the Neuroscience/Psychology department. Dr. Kirwan is one of the directors at the MRI research facility and has specific expertise in functional brain imaging. He worked with Dr. Jensen on the Go No-Go study we will be comparing our data against. I have previously worked together with Dr. Kirwan on a fMRI study.

The Department Honors Coordinator is Richard Bobo.

E. Project Timeline

May 20th, 2017 – submit IRB

June 20th, 2017 – resubmit IRB if necessary with any changes

July 1st, 2017 – begin recruitment

July – November 2017 – run participants through the study protocol, collect data

October 27th, 2017 – present preliminary data at the Snowbird Neuroscience Symposium

October 2017 – submit abstract for the American Psychosomatic Society annual meeting

November 2017 – analyze data

December 2017 – finish data analysis

January – April 2017 – prepare manuscript for publication

March 2017 – present preliminary data at the American Psychosomatic Society annual meeting

April 2017 – defend Honors Thesis

References

- Batterink, L., Yokum, S., & Stice, E. (2010). Body mass correlates inversely with inhibitory control in response to food among adolescent girls: An fMRI study. *Neuroimage*, 52(4), 1696-1703.
- Berger, A., Kofman, O., Livneh, U., & Henik, A. (2007). Multidisciplinary perspectives on attention and the development of self-regulation. *Progress in Neurobiology*, 82, 256-286.
- Choi, W. J., Kwon, H. J., Lim, M. H., Lim, J. A., & Ha, M. (2016). Blood lead, parental marital status and the risk of attention-deficit/hyperactivity disorder in elementary school children: A longitudinal study. *Psychiatry Research*, 236, 6-42.
- Epstein, J. N., Delbello, M. P., Adler, C. M., Altaye, M., Kramer, M., Mills, N. P., Strakowski, S. M., & Holland, S. (2009). Differential patterns of brain activation over time in adolescents with and without attention deficit hyperactivity disorder (ADHD) during performance of a sustained attention task. *Neuropsychiatry*, 40, 1-5.
- Evans, W. N., Morrill, M. S., & Parente, S. T. (2010). Measuring inappropriate medical diagnosis and treatment in survey data: The case of ADHD among school-age children. *Journal of Health Economics*, 29, 657-673.
- Humphreys, K. L., Katz, S. J., Lee, S. S., Hammen, C., Brennan, P. A., & Najman, J. M. (2013). The association of ADHD and depression: Mediation by peer problems and parent-child difficulties in two complementary samples. *Journal of Abnormal Psychology*, 122, 854-867.
- Mastoras, S. M., Saklofske, D. H., Schwan, V. L., & Climie, E. A. (2015). Social support in children with ADHD: An exploration of resilience. *Journal of Attention Disorders*, 1-12.
- Rajendran, K., Kruszewski, E., & Halperin, J. M. (2015). Parenting style influences bullying: A

longitudinal study comparing children with or without behavioral problems. *Journal of Child Psychology and Psychiatry*, 2, 188-195.